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CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

Volume 33, No. 2

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Front Cover: *Drosera spatulata* 'Ruby Slippers'. Photograph by William Joseph Clemens. Article on page 52.

Back Cover: A leaf blade of *Utricularia reniformis* 'Big Sister', measuring 175 mm across, documented in Serra dos Órgãos, Brazil. Photograph by Miloslav Studnicka. See article on page 52.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

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ICPS, Inc.
PMB 330
3310 East Yorba Linda Blvd.
Fullerton, CA 92831-1709, USA
icps@carnivorousplants.org

President
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Carl Mazur, email: carl@carnivorousplants.org
Cindy Slezak, email: cindy@carnivorousplants.org
Richard Myers, email: richard@carnivorousplants.org
John Brittnacher, email: john@carnivorousplants.org, seedbank listed in this issue.
Chris Teichreb, email: chris@carnivorousplants.org
Steve LaWarre, email: stevell@carnivorousplants.org

Editors:

Barry A. Rice, P.O. Box 72741, Davis, CA 95617, USA, email: barry@carnivorousplants.org
Jan Schlauer, Zwischenstr. 11, D-60594 Frankfurt, Germany, email: jan@carnivorousplants.org
Page Layout: Steve Baker, email: steve@carnivorousplants.org

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<i>Drosera anglica</i> —Alaska, USA	<i>D. intermedia</i> —Venezuela
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<i>D. filiformis</i> var. <i>filiformis</i>	<i>N. rafflesiana</i>
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<i>D. intermedia</i> —Germany	<i>Utricularia calycifida</i>
<i>D. intermedia</i> —New Jersey, USA	<i>U. multifida</i>

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Seed packets are US\$1 each. Please include US\$3 postage and handling for each order. You may pay by cash, check, or money order in US\$. Many members pay with cash. Please make checks and money orders payable to "ICPS Seed Bank".

The seed bank is a members-only benefit. The quantity of seed available to each member is 1 packet of each variety per month and 40 packets total in any 12 month period. Please list alternative seed selections, as other orders will arrive before yours. If you have an e-mail address, please include it so we can correspond should any issues arise. Seeds purchased through the seed bank are intended for your personal use only and may not be sold.

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John Brittnacher, Manager • john@carnivorousplants.org

EXPERIENCES WITH PROPAGATION OF *SARRACENIA FLAVA* (SARRACENIACEAE) THROUGH DIVISION WITH ONLY ONE GROWING SPOT

TOBIAS ISENBERG • Aschberg 11 • D-39638 Gardelegen • Germany • tobias.isenberg@web.de

Keywords: cultivation: propagation, *Sarracenia flava*.

Vegetative propagation of *Sarracenia* is performed by rhizome division (see, for example, D'Amato (1998), page 100, or Slack (2000), page 199). However, usually only plants with more than one growing spot are divided, yielding as many plants as there were original growth tips. In this article I describe how I successfully divided a *Sarracenia flava* plant with only one growing spot into two separate plants.

I had bought my specimen of *Sarracenia flava* as a young plant at my local gardening center, and grew it in a tray in a south-facing windowsill. I used a potting medium of peat and perlite. Over the following years it grew larger and developed sturdy, 50 cm (20 in) green pitchers with red necks. It flowered once, and also once required repotting.

Last spring, the rhizome had become about 12 cm (5 in) long and again required a new pot—the rhizome was already pushing at both sides of the plastic pot, deforming it into an oval shape. Instead of repotting the plant in a larger pot, I decided to cut off a part of the rhizome so that the plant would fit into the pot. Unfortunately, the plant had only one growing spot (I later learned of techniques to induce the growth of other growing spots by cutting small notches into its top but did not know of this at the time).

I used a sharp knife to carefully cut the rhizome into two 6 cm (2.5 in) segments. I had to delicately separate the intertwined roots of the two rhizome parts, which was not easy. One rhizome segment had a growing tip, but the other only had roots. Although fungicides, charcoal, or B-1 solutions are usually recommended in this situation (for example Carow & Fürst (1993), page 14), I did not have any.

I repotted the rhizome segments into two separate pots. Even though one segment had no growth tip, it was strong and healthy looking so I decided to give it a try. I waited to see what would happen. Since the one segment had no leaves, I put it in a place in my back yard where it did not get light, but would get some rain once in a while. During the first weeks, I looked after it regularly. Nothing happened. Then, the times without attention got longer. However, I still looked at it once in a while to test whether the rhizome was rotten or still nice and strong. It stayed strong and did not decay, without change, for days, for weeks, even for months. At some point in time when the weather outside got colder I moved the pot inside to be next to its mother plant. The mother plant spent the summer making a few nice pitchers, although they were considerably smaller than they used to (about 30 cm; 12 in), probably due to the shock from division (see Figure 1).

Finally in October, a tiny red leaflet appeared in the daughter pot, which started to grow and turn into a small leaf. But that was not all! After the first new growing spot two more appeared and started to grow small leaves. By November, the largest leaf from the first spot was about 12 cm (5 in) long and showed the well-known shape of a *Sarracenia flava* pitcher (see Figure 2). By this time, the mother plant was producing winter phyllodia. This February, the mother plant produced a nice flower which was even bigger than the one it had made before. Hopefully, within a few years, it will again produce the big pitchers that it used to grow.

I hope this experience will help other growers who cultivate *Sarracenia* plants of which the rhizomes have become too long but which have only one growing spot. Just go and try cutting the rhizome apart and by that propagate the plant!

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- Slack, A. 2000, *Carnivorous Plants*, MIT Press, Cambridge, Massachusetts.



Figure 1: The mother plant with the original growing spot, flowering in February.



Figure 2: The new plant with the two growing spots.

NEWS AND VIEWS

Jonathan Svend McQuay (Peterborough, NH 03458, USA) writes: I read a small article in the July/August 2002 issue of *National Geographic World* about some scientists from Iowa State University. They discovered that catnip repels mosquitoes ten times better than most other repellants would.

Recently I have had mosquitoes laying eggs in my carnivorous plant trays. Because of this I had to move my prized carnivorous plants and pour out the water. Then I saw some catnip at a fair and decided to see if it would help. I put a 1/2 teaspoon of dried catnip (fresh would probably work better as it is the oil that repels) per quart in and no more mosquitoes!

Although this technique is cheap and wonderfully effective, it could cost cat owners dearly!

Barry Rice (barry@carnivorousplants.org) writes: During a recent business trip to Fort Lauderdale, Florida, I found, much to my delight, both *Utricularia gibba* and *U. foliosa* growing well in urban ponds. The latter was fruiting; in fact the ponds were dotted with armadas of fruit that had popped off the inflorescences and were bobbing on the water surface. I dissected these fruit (quite large, at about 1 cm diameter) and observed that each contained several of the large, disc-shaped seeds so well illustrated by Taylor in his *Utricularia* monograph. I collected about twenty of the fruit for study. I found that when kept in water, the fruit stayed fresh and, in about four days, expelled their coats and released the seed. In my less than ideal cultivation conditions, only one of the seeds germinated.

Even though the germination rate was so low in my small experiment, I am struck by this dispersal mechanism which is relatively uncommon in carnivorous plants. I wonder if there is even more to this story—perhaps waterfowl may eat the fruit and pass viable seeds.

THE CONSERVATION AND DISPLAY OF SOUTHEASTERN U.S. PITCHER PLANT BOGS AT THE CROSBY ARBORETUM

ROBERT F. BRZUSZEK • The Crosby Arboretum • Mississippi State University Extension • P.O. Box 1639 • Picayune, MS 39466 USA • crosbyar@datastar.net

Keywords: live collections: preserves, Mississippi (USA).

With increasing value being placed on our natural heritage, The Crosby Arboretum, Mississippi State University Extension, is the premier native plant education facility of the Gulf Coastal Plain. The Arboretum allows us to study and learn about indigenous plants and plant products so that we may use them to their best advantage and ensure their continuous propagation in the future. Through the Crosby Arboretum, aesthetic, agricultural, scientific, and industrial contributions of native plant species and ecosystems can be examined in a real-life setting.

The Arboretum began as a living memorial to L.O. Crosby, Jr. in 1978. It has expanded to become a resource for education in the region and the world. The Arboretum provides for the protection of the region's biological diversity as well as a place for the public's enjoyment of regional native plant species.

The Setting

Arboretum lands lie within a diverse floral portion along the Gulf of Mexico known as coastal meadows. Coastal meadows comprise a low-lying generally flat area extending from the Gulf of Mexico shoreline from five to thirty miles inland. Elevations in this area do not exceed thirty feet above sea level. Occasional swamps and marshes mark the land, as well as sand ridges, where beach dunes once existed. The soil, dating from Eocene to Holocene in age, is sandy and grayish in the higher parts and black, peaty, and acid in the low-lying areas where water sometimes stands. The movement of water through the soil in lower areas is slow, and soils are strongly acidic, ranging in pH from 3.5 to pH 5.0. An open growth of pine savanna covers the area; and on the wet, acid soils there exists undergrowth similar to that of northern bogs.

Fire is an important part of the natural history of the pine woodlands, predating the coming of man around 20,000 years ago. In the past, lightning was responsible for fires approximately 5 out of 10 years in both the longleaf pine forests and in the more open bogs and savannas. This long association of the plant communities of the Piney Woods with fire has resulted in many adaptations now evident. Early land uses for agriculture and forestry has continued the use of prescribed fire for land management, until recent times with increasing land use changes. It is estimated that less than 3% of the Gulf Coast's original pitcher plant bog habitat remain. This staggering loss is certainly attributed to agriculture and grazing, and filling in for development; but primarily lost to the cessation of regular fire intervals.

The coastal meadows have a humid, warm temperate to sub-tropical climate. Annual precipitation averages 170 cm (66 inches) per year, with the heaviest rainfalls occurring in late spring to summer months. Torrential rains and strong winds—often with drastic effects upon vegetation—accompany the occasional hurricanes that cross the land. The mean temperature is 20.5°C (69°F) and the annual mean relative humidity is 76 percent.

This unique setting of our region gives birth to the conservation efforts, research, and educational exhibits of the Crosby Arboretum. The Arboretum is composed of seven different natural areas, totaling nearly 400 ha (1,000 acres), and is managed for conservation and research efforts. This vast assemblage of carefully selected and protected lands nurtures over 700 species of indigenous trees, shrubs, wildflowers, and grasses found along the Gulf Coast. The major veg-



Figure 1: The author conducting a prescribed burn. Photograph by L. Pardue.



Figure 2: Raised boardwalk through the bog. Photograph by R. Brzuszek.



Figure 3: Volunteers assisting with a bog rescue. Photograph by R. Brzuszek.

etation types, based upon a continuous interplay of fire and moisture regimes, include: longleaf pine, longleaf pine-scrub oak, slash pine, slash pine-hardwoods, sweetbay-tupelo-swampbay, beech-magnolia, baldcypress-tupelo, bottomland hardwoods, and shrub bogs, hillside bogs, and savannas (McDaniel, 1986).

The Flora

Shrub bogs, hillside bogs, and savannas are three closely related vegetation types and similar in species composition. Moreover, all three types frequently include large numbers of pitcher plants. Generally the shrub bogs and hillside bogs are somewhat wetter than savannas. In fact, occasionally they may be so wet that they shake when walked upon.

A shrub bog may be defined as an area with bog vegetation, especially pitcher plants, surrounded or broken by areas of shrubs or small trees. The shrubs or small trees are mostly evergreen or at least tardily deciduous. One of the rarest woody plants of the Gulf Coast region, bog spicebush (*Lindera subcoriacea*), was discovered in an Arboretum shrub bog about twenty years ago.

Hillside bogs are similar to shrub bogs but, lacking the break of intervening shrubs, are more open. They also have greater changes in elevation than shrub bogs or savannas. Hillside Bog Natural Area, a 28 ha (70 acres) section of Crosby Arboretum, is a spectacular sight espe-

cially after a winter burn, with literally hundreds of thousands of pitcher plants. In addition to pitcher plants, hillside bogs are quite diverse in herbaceous species including orchids, sedges, grasses, yellow-eyed grass (*Xyris* spp.), lady's hats (*Eriocaulon* spp.), and other herbs.

Savannas in our area are flat, frequently wet, with scattered slash or longleaf pine present. As a result of frequent fires and abundant sunlight, savannas have a rich herbaceous flora including several species of pitcher plants and other carnivorous plants, orchids, diverse sedges, and numerous grasses. Many of the plants are restricted to this environment.

Few places in the world can rival the diversity of carnivorous species than in southeastern U.S. pitcher plant bogs. According to noted biologist, George W. Folkerts, over half of the approximately forty-five North American carnivorous species occur along the Gulf Coast (Folkerts, 1982). Similarly, these pitcher plant bogs are equally diverse in many plant genera. Research conducted on Crosby Arboretum lands have documented in excess of 40 plant species per square meter.

The carnivorous plants of Gulf Coastal bogs include species of sundews (*Drosera*: Droseraceae), bladderworts (*Utricularia*: Lentibulariaceae), butterworts (*Pinguicula*: Lentibulariaceae), and pitcher plants (*Sarracenia*: Sarraceniaceae). Species recorded on Arboretum lands include *Drosera capillaris*, *D. intermedia*, *D. brevifolia*, *Pinguicula lutea*, *P. primuliflora*, *Sarracenia alata*, *S. psittacina*, *Utricularia cornuta*, *U. gibba*, *U. juncea*, and *U. subulata*. Prescribed fire is routinely conducted for management purposes in Arboretum natural area bogs every 5 out of 10 years.

A Novel Idea

In addition to the preservation of local plant communities in its natural areas, The Crosby Arboretum has an additional public center site, located in Picayune, Mississippi. Pinecote, as the center is known, is a 42 ha (104 acre) native plant facility and serves as the focus of activities and development. Unique in the garden world, the Arboretum features native plants exclusively in *in situ* environments.

Pinecote is a land of many changes. Originally a wet pine flatwood, the site was clear-cut of its longleaf and slash pine in the early 1900s. Experimental crops such as strawberries were grown on the land in the 1930s, and resulted in a network of roads and ditches to help the site. Pines were replanted in the 1940s and maintained by prescribed fire until the early 1980s.

The concept for Pinecote was to create and manage native plant communities that that reflect the flora of our region. It was decided to exhibit three main environments—aquatic, woodland, and savanna ecosystems. The savanna ecosystem was fairly easy, since the site was already maintained by fire. Twenty-four hectares (60 acres) of savanna were designated for this purpose. The woodland exhibit was to develop over the course of time by allowing 16 ha (40 acres) of savanna to transform by natural succession. Species missing from the site would be added as part of the restoration program. The aquatic exhibit was constructed in 1986, and features a 1 ha (2 acre) beaver pond and a 0.2 ha (0.5 acre) slough exhibit.

Next came the task of determining which plant communities would be displayed, restored, and managed within each of the three environments. Botanists from Mississippi State University established a 30 m × 30 m (100' × 100') grid system over the entire Arboretum site. From this they noted the existing plants and elevation changes within each of the grid systems. Research monitoring is conducted at periodic intervals to determine the species changes over time.

In the Savanna Exhibit, under the influence of fire, the higher elevations evidenced an emerging longleaf pine forest. These zones were designated for the management and restoration of longleaf pine and associated herbaceous species. In the lower wet areas, it was surmised that an existing pitcher plant bog had once occurred on the site, and was lost due to past agricultural use. These wet zones were designated for pitcher plant restoration. Other developing savanna community exhibits include *Sphagnum* moss flats, Slash pine lowlands, Baygalls, and other transitional communities.

From research and observation in our natural areas, restoration efforts were then initiated in each of the exhibits. The relative frequencies, dominance, and spatial characteristics of plant species were evaluated and compared to natural area sites. Longleaf pines were replanted to reflect natural groupings. Associated missing herbaceous species found in natural areas but not on the Arboretum site were directly seeded or planted in. All plantings were selected from plants of local genotype by purchasing from local native plant nurseries. Prescribed fire is introduced to all Savanna and Bog Exhibits on a regular basis.

The Pitcher Plant Bog Exhibit is approximately 1.6 ha (4 acres). Many wetland herbaceous plants such as spikerush (*Eleocharis* spp.), giant plumegrass (*Erianthus gigantea*), blazing star (*Liatris* spp.) and swamp sunflowers (*Helianthus angustifolia*) were already present, but no carnivorous species were in the site. To reflect the majesty of our regional bogs, both species of pitcher plants found in our county (*Sarracenia psittacina* and *S. alata*) were introduced, *en masse*.

We obtained the majority of our pitcher plants and other bog plants from rescues at local development sites. Unfortunately, privately owned small bogs (under 0.4 ha, 1 acre) are not protected by federal wetland laws and are frequently converted to fish ponds and other uses. When we learn about these events, we first try to educate the landowner about preserving the sites. If this does not work, we obtain permission from the landowner to conduct an emergency rescue, and then assemble volunteers to save as many plants as possible.

Over the course of ten years, thousands of pitcher plants have been relocated to the Pitcher Plant Bog Exhibit. We have had nearly 100% success in transplanting, even during an extreme drought in 2000. A wooden boardwalk 370 m (1200 feet) long traverses the bog and allows visitors a close view without trampling the tender ecosystem.

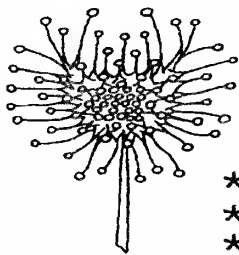
The result of this public display area has been an extraordinary opportunity to teach people about the magical workings and wonders of the southeastern U.S. pitcher plant bogs. Our goal is to have an enlightened public and help foster their conservation and preservation of this disappearing habitat. To achieve this, the Crosby Arboretum regularly conducts public programs on prescribed burning, pitcher plant bog tours, and plant sales of propagated bog plants.

For more information on the Crosby Arboretum, please visit our website at <http://msstate.edu/dept/crec/camain.html>.

References:

- McDaniel, S. 1986, Guide to the Natural Areas of The Crosby Arboretum. The Crosby Arboretum, Picayune, Mississippi.
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A NEW MEXICAN SPECIES OF *PINGUICULA* (LENTIBULARIACEAE)

HANS LUHRS • Krayenhoffstr. 51 • 1018 RJ Amsterdam • Holland

MILOSLAV STUDNICKA • Botanical Gardens Liberec • Purkynova 1 • 460 01 Liberec • Czech Republic

OLIVER GLUCH • Franz-Hartard-Str. 38 • 67376 Harthausen • Germany

Keywords: new taxa: *Pinguicula pilosa*, Mexico.

Received: 25 November 2003

Abstract

A new species of *Pinguicula* from the state of Tamaulipas, northeastern México is described and illustrated: *Pinguicula pilosa* (subgen. *Isoloba*). This new species shows affinity with *P. agnata* Casper from the section *Agnata*, and differences in both floral and foliage features are discussed.

Introduction

This new species, discovered by Alfred Lau, has been grown in cultivation and distributed under various names since approximately 1984. Because of lack of a taxonomic description and name, and confusion that may be caused in the near future, it is therefore described here as *Pinguicula pilosa*. The specific epithet refers to the hairy appearance of the flower scape and calyx.

Result and Discussion

Pinguicula pilosa Luhrs, Studnicka et Gluch, *spec. nov.* (Figure 1). TYPE: MEXICO. Tamaulipas: distr. Casas, Sierra de Tamaulipas, near El Cabrito, A. Lau s.n.; cultivated in the Botanical Garden of Liberec, Czech Rep., 29/Jan/1996, M. Studnicka (Holotype: TEX!).

Herba perennis. Rhizoma simplex brevis, radicibus filiformibus adventitiis numerosis. Folia radicalia rosulata, biformia, laete viridia; rosula "lucida" 12-18, crassa, oblanceolata vel spatulata, 10-20 mm longa, 6-12 mm lata, superne glanduloso-hirsuta dense vestita; rosula "aestatis" 8-12, late obovata vel suborbiculata, apice rotundata, basin versus late cuneatim angustata subpetiolata, margine leviter involuta, superne glandulis sessilibus et glandulis stipitatis dense vestita, 25-40 mm longa, 20-30 mm lata. Hibernacula nulla. Pedicelli 1-3 erecti, pallide purpurei, pilosi, pilis longis subulatis disperse et glanduloso-hirsutis dense obsiti, (35-)70-90 mm alti, uniflori. Flores (16-)22-25 mm longi (calcarei incluso). Calyx bilabiatus, extus pilosus, pilis longis subulatis disperse et glanduloso-hirsutis dense obsitus; labium superum trilobum, lobis ovatis vel oblongis, 2.5-3.0 mm longis, 2.0-2.5 mm latis; labium inferum bilobum, lobis anguste ellipticis, 3.0-3.5 mm longis, 1.5-2.0 mm latis. Corolla subisoloba, pallide violacea (RHS violet 85C), in fauce albo-maculata, extus glandulis stipitatis modice dense vestita; lobis subaequalibus, late cuneatis vel obovato-cuneatis vel suborbiculatis, apice obtusis vel rotundatis, 8-12 mm longis, 8-12 mm latis, integris pilosis, pilis longis cylindricis subcapitatis dense vestitis. Tubus subcylindricus, viridi-flavus, basin versus leviter angustatus, 6-7 mm longus, 4 mm latus, extus glandulis stipitatis dense obsitus, intus pilosus, pilis longis cylindricis et pilis longis clavatis subcapitatis, sine palato. Calcar subcylindricum, plus minusve incurvum, obtusum, viridi-flavum, 4-5 mm longum, 1.5-2.0 mm latum, glandulis stipitatis obsitum, cum tubo angulum obtusum ($\pm 90^\circ$) formans. Stamina 1.5 mm longa. Ovarium subglobosum, glandulis stipitatis parvulis obsitum. Stigma bilabiatum, album, labio infero superiorem superanti, suborbiculato, fimbriato. Capsula subglobosa ± 3 mm diam. Semina ignota. Florescentia I-III (-IV).

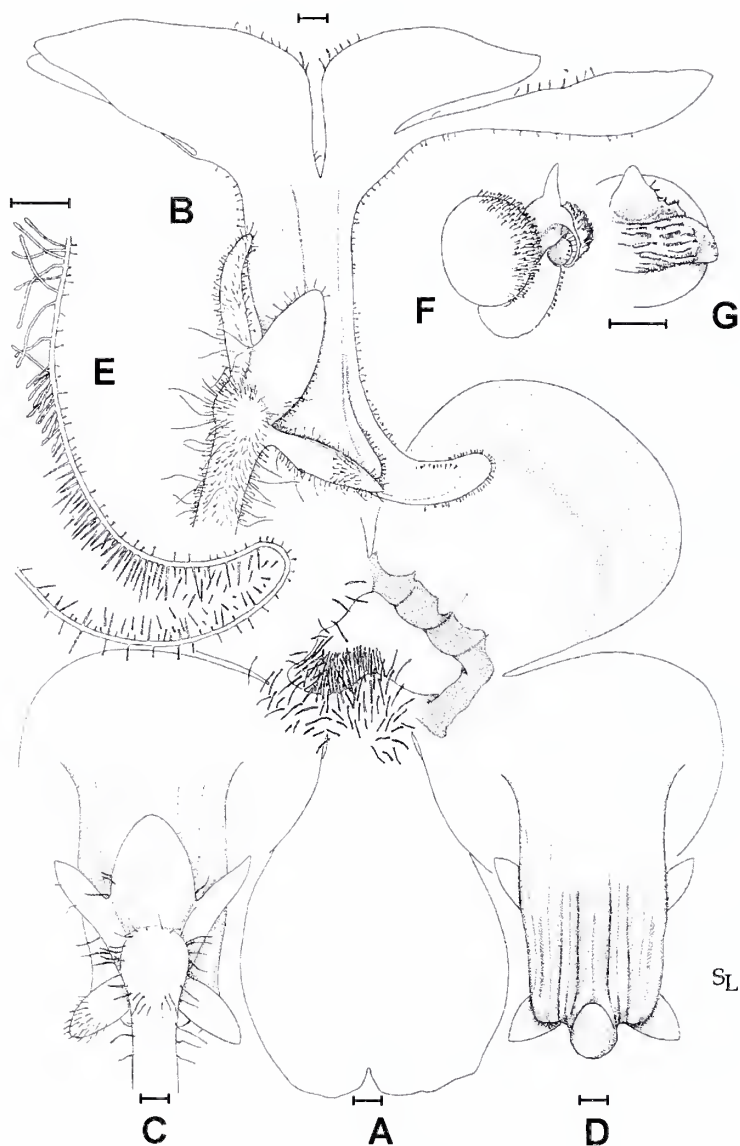


Figure 1: *Pinguicula pilosa* Luhrs, Studnicka & Gluch; A: corolla; B: flower, lateral view; C: calyx; D: corolla tube, lower side; E: corolla tube, inside view showing different hairs; F: ovary, stamen and stigma; G: stigma. Scale bars A-D 1 mm, E-G 0.1 mm. Illustration by Stan Lampard.

Perennial herb. Stem short, with numerous fibrous adventitious roots. Leaves rosulate, dimorphic, bright green; those of the winter rosette 12-18, thick, oblanceolate or spatulate, the surface covered with fairly coarse glandular hairs, 10-20 mm long, 6-12 mm wide; those of the summer rosette 8-12, broadly obovate or suborbiculate, rounded at the apex, broadly cuneate towards the base narrowing into a short petiole, the margin lightly involute, the surface covered with sessile and stalked glands, 25-40 mm long, 20-30 mm wide. Hibernaculum absent. Scapes 1-3, erect, pale purple, covered with long subulate and fine glandular hairs, (35-)70-90 mm tall, 1-flowered. Flowers (16-)22-25 mm long (including the spur). Calyx 2-lipped, covered with long subulate and fine glandular hairs; upper lip 3-lobed, the lobes ovate or oblong, 2.5-3.0 mm long,

2.0-2.5 mm wide; lower lip 2-lobed, the lobes elliptic or narrowly elliptic, 3.0-3.5 mm long, 1.5-2.0 mm wide. Corolla subisolate, pale violet (RHS violet 85C), white in the centre, the outer surface covered with stalked glands; the lobes subequal, broadly cuneate, obovate-cuneate or suborbiculate, obtuse or rounded at the apex. 8-12 mm long, 8-12 mm wide, entirely and densely covered with long cylindrical subcapitate hairs. Tube subcylindrical, greenish-yellow, lightly narrowing towards the base, covered with small stalked glands, 6-7 mm long, 4 mm wide, the inside covered with long cylindrical and clavate subcapitate hairs, palate absent. Spur subcylindrical, more or less curved inwards, obtuse, greenish-yellow, covered with small stalked glands, 4-5 mm long, 1.5-2.0 mm wide, forming an obtuse angle ($\pm 90^\circ$) with the tube. Stamen 1.5 mm long. Ovary subglobular, covered with tiny stalked glands. Stigma 2-lipped, whitish, lower lip much larger than the upper lip, suborbiculate, margin fimbriate. Capsule subglobular, ± 3 mm in diameter. Seed unknown. Flowering January-March(-April).

Pinguicula pilosa inhabits a small and remote mountain range in southern Tamaulipas, and although the distribution of this species appears to be restricted within the area, further details of habitat and geographical range remain unknown.

This new species belongs to the subgenus *Isoloba* as defined in Casper's monograph of the genus *Pinguicula* (1966). Despite its dimorphic leaves, *P. pilosa* is best placed in the section *Agnata* which is characterized by a corolla with almost equal lobes, a long cylindric tube, the absence of a palate, and a cylindrical spur longer than wide that forms a distinct angle with the tube. Although the features of section *Agnata* match with the flower characteristics of *P. pilosa*, those of section *Heterophyllum*, characterized by dimorphic leaves, conform to a lesser degree with the latter's flower characteristics. Within section *Agnata* it shows affinity with *P. agnata* (subsect. *Agnata*) but differs from this species by features which are noted in Table 1. below.

	<i>P. pilosa</i>	<i>P. agnata</i>
Winter leaf	Oblanceolate or spatulate, 10-20 mm long/6-12 mm wide.	Obovate, apex rounded, 18-35 mm long/8-14 mm wide.
Summer leaf	Broadly obovate or suborbicular, apex rounded, margin involute, 25-40 mm long/20-30 mm wide.	Spatulate or obovate-oblong, apex blunt, margin not involute, 35-70 mm long/15-30 mm wide.
Scape	Covered with long subulate and fine glandular hairs, 35-90 mm long.	Covered with glandular hairs, 50-140 mm long.
Calyx	Covered with long subulate and fine glandular hairs, upper lobes up to 1/3 connate, lobes ovate or oblong / elliptic or narrowly elliptic, pressed to the corolla.	Covered with glandular hairs, upper lobes completely separated, lobes broadly ovate acute/ovate-oblong, the apex turned backwards.
Corolla	Pale violet, white in the centre, and a green-yellow throat, entirely and densely covered with long cylindrical subcapitate hairs.	White, with pale blue edges, and purple markings in the throat, almost entirely covered with long cylindrical subcapitate hairs.
Corolla lobes	Broadly cuneate, obovate-cuneate or suborbicular, apex blunt or rounded, 8-12 mm long/8-12 mm wide.	Obovate-oblong or subcuneate, apex blunt or rounded, 7-10 mm long/6-9 mm wide.
Tube	6-7 mm long/4 mm wide.	6-10 mm long/3-5 mm wide.
Spur	forming an angle of 90° with the tube, 4-5 mm long/1.5-2.0 mm wide.	Forming an angle distinctly larger than 90° with the tube, 3-4 mm long/1.5-2.0 mm wide.
Flowering	Winter rosette only.	Winter and summer rosette

Table 1. Comparison of the characteristic features of *Pinguicula pilosa* and *P. agnata*.

Acknowledgements

The authors are greatly indebted to Prof. Dr. B.L. Turner (Dept. of Botany, University of Texas, U.S.A.) for reviewing the manuscript, to Dr. B. A. Rice and Dr. J. Schlauer for their useful comments, and to Stan Lampard for providing the drawing.

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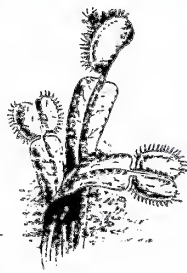
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OBSERVATIONS ON TWO DIFFERENT FORMS OF *UTRICULARIA RENIFORMIS*

MILOSLAV STUDNICKA • Botanic Gardens Liberec • Purkynova 1 • 460 01 Liberec • Czech Republic • botangarden@volny.cz

Keywords: observations: *Utricularia reniformis*.

Introduction

The species *Utricularia reniformis* A.St.Hil. is occasionally grown by specialists, who appreciate its large leaves and spectacular flowers. I have observed two different forms of this plant in our collection, and hoped to learn more about it in the literature. Merl (1915) noted there were different sized types of this plant, however Taylor (1989) considered the two types merely to be extremes of species variation. As such, Taylor did not consider them separate species (nor did he accept subspecific taxa in the genus).

Since these plants are of interest to horticulturists, I helped register cultivar names for these two plants (see Rice & Studnicka (2004), for precise details on their differences). The larger plant is called *Utricularia reniformis* 'Big Sister', the smaller is called *Utricularia reniformis* 'Enfant Terrible'.

In this paper, I present new observations about these two cultivars. These observations support the possibility that the two cultivars may be selections from distinct species, and that *Utricularia reniformis* as described in Taylor (1989) may actually be more than one species.

Material and Methods

In all genera of carnivorous plants, the carnivorous trapping organs are generally the most specialized and modified organs. This specialization, so useful in taxonomy, is clearly evident in the large carnivorous plants such as *Nepenthes* and *Sarracenia*, but it is also expressed in the small bladders produced by *Utricularia* species (Thor, 1979; Taylor, 1989; Jobson & Albert, 2002). In this study, living bladders produced by the two plants *Utricularia reniformis* 'Big Sister' and *Utricularia reniformis* 'Enfant Terrible' were examined under a microscope for differences and general characteristics. Plants of three provenances were investigated: 1) *Utricularia reniformis* 'Big Sister', cultivated in the Botanic Gardens of Liberec, Czech Republic, natural origin undetermined; 2) *Utricularia reniformis* 'Enfant Terrible', cultivated in the Botanic Gardens of Liberec, Czech Republic, natural origin undetermined; 3) *Utricularia reniformis* 'Big Sister', studied on 12 December, 2000 in situ in Brazil, Serra dos Órgãos, Pedra do Sino near Teresopolis, 1750 m above sea level. The types #1 and #2 were established in the same planting medium¹, and were grown in pots with apertures in the pot walls to enable the plants to grow from the pot into surrounding water.

Bladders were extracted from the soil and water and observed. Leaf epidermis layers were also observed and compared. Comparative results of the bladder and epidermis observations are discussed below.

Variations in Bladder Structure

There are striking inconsistencies in the published drawings of the bladders of *U. reniformis* (see Figure 1). According to Taylor (1989) the trap bears short, relatively stout recurved antennae, similar to those in traps of epiphytic species like *U. alpina*, *U. endresii*, etc. This type of traps are probably specialized to fluctuating moisture levels. I designate this trap as an "epiphytic

¹The planting medium consisted of equal parts of peat moss, 1 cm chunks of polystyrene, and pieces of poplar bark and beech leaves (*Populus nigra* and *Fagus sylvatica*, respectively).

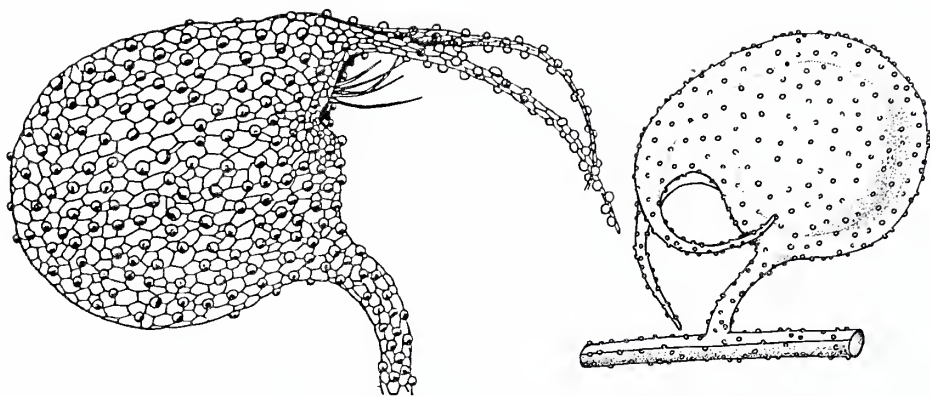


Figure 1: *Utricularia reniformis* bladder drawings in literature: left, from Luetzelburg (1910); right, from Taylor (1989, Figure 131/9 redrawn by R. Novotná). The vesicles of *Utricularia reniformis* are different in position of antennae and exposition of trap entrances (an “aquatic” and an “epiphytic” trap).

bladder.” In contrast, the bladder illustrated by Luetzelburg (1910) bears long, slender antennae reflexed away from the bladder entrance, much like as often seen in aquatic species. These traps are apparently adapted to a fully aquatic existence and, if they are situated in soil, to the presence of gravitational water (that is, water not predominantly bound by capillary effects between soil particles). I designate this trap as an “aquatic bladder.”

Bladders of *Utricularia reniformis* ‘Big Sister’ are all of the aquatic form. Figure 2a shows a representative bladder of this plant from an aquatic shoot. The bladder antennae are nearly as long as in Luetzelburg’s illustration. Note that antennae are reflexed away from the bladder opening. Bladders of this plant extracted from soil have shorter antennae (see Figure 2b), however they are still recurved from the trap opening (or at least do not strongly curl around the front of the bladder) and so I still classify them as the aquatic form. All the bladders of *Utricularia reniformis* ‘Big Sister,’ regardless of their various sizes or locations in the environment, have antennae that are deflected from the bladder entrances.

Bladders of *Utricularia reniformis* ‘Enfant Terrible’ located in the soil are of the epiphytic form (see Figure 2d). The antennae are strongly curved around the bladder opening. The aquatic shoots of this plant, which are never so pronounced as the aquatic shoots of *Utricularia reniformis* ‘Big Sister,’ are also predominantly equipped with epiphytic bladders. Nevertheless, one can occasionally find large, aquatic bladders bearing the characteristically long antennae (see Figure 2c). These antennae are curved away from the bladder opening.

Leaves and Heterophylly

As discussed in the article that establishes the cultivar names *Utricularia reniformis* ‘Big Sister’ and *Utricularia reniformis* ‘Enfant Terrible’ (see Rice & Studnicka, 2004), the former plant produces large leaves while the latter produces both medium leaves and minute to small ground leaves (see also Merl, 1915).

In addition to the primary differences between these two plants that are noted in the cultivar descriptions, I have observed differences in the epidermal features (see Figure 3). All the leaves of *Utricularia reniformis* ‘Big Sister’ (see Figures 3a-b), and the medium leaves of *Utricularia reniformis* ‘Enfant Terrible’ (see Figures 3c-d) bear stomata only on the lower surface. In contrast, the ground leaves of *Utricularia reniformis* ‘Enfant Terrible’ bear stomata on both the lower and upper surfaces (see Figures 3e-f)!

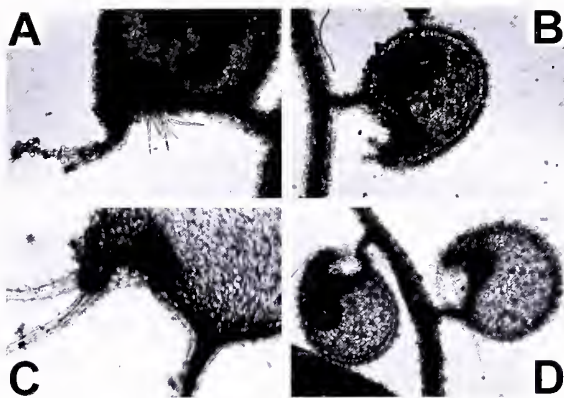


Figure 2: A: *Utricularia* 'Big Sister' bladder from water; B: *Utricularia* 'Big Sister' bladder from soil; C: *Utricularia* 'Enfant Terrible' bladder from water; D: *Utricularia* 'Enfant Terrible' bladder from soil.

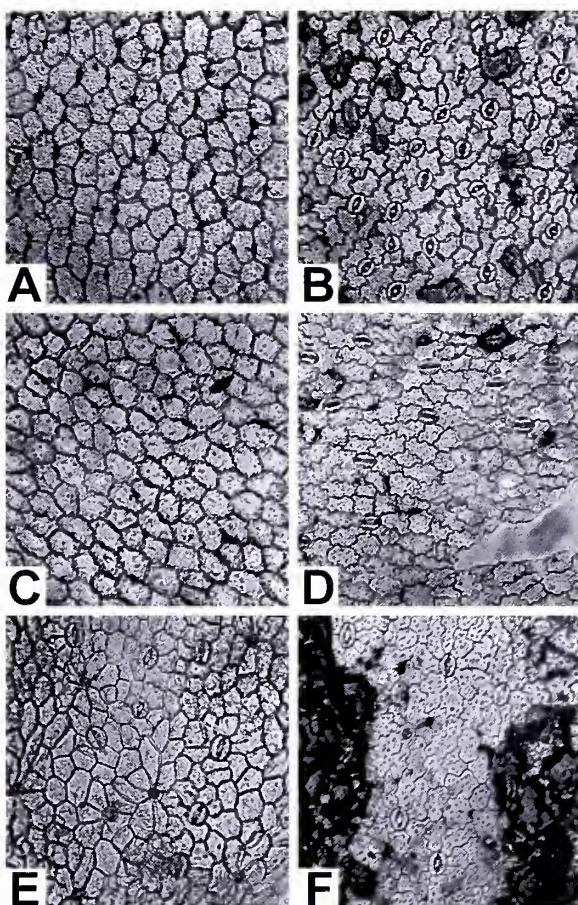


Figure 3: Leaf epidermis samples from *Utricularia reniformis*. A: *Utricularia* 'Big Sister' upper surface; B: *Utricularia* 'Big Sister' lower surface; C: *Utricularia* 'Enfant Terrible' upper surface of large leaf; D: *Utricularia* 'Enfant Terrible' lower surface of large leaf; E: *Utricularia* 'Enfant Terrible' upper surface of small ground leaf; F: *Utricularia* 'Enfant Terrible' lower surface of small ground leaf.

According to my field observations on the wet granitic slopes in Serra dos Órgãos, *Utricularia reniformis* 'Big Sister' depends upon the large lithophytic *Vriesea atra* for suitable habitat. However, this bladderwort can also survive outside of the bromeliad, growing well in soggy humus. I believe that the principal advantage to the lifestyle of growing in the bromeliad is realized for the seedling bladderworts. These floating plantlets benefit from the reliable supply of water in the central tanks of the voluminous bromeliads, quite similar to the case of *U. lumboldtii* in the Guiana Highland. (This hypothesis is supported by the fact that the seeds of both species have green non-dormant embryos which germinate immediately in contact with water.)

Both of these plants inhabit bromeliads occurring in areas of cloud forest, especially in rock slope clearings. Mist is an important and reliable source of water, which is certainly the reason of the mentioned "aquatic" traps in *U. reniformis*, and, of course, also in *U. lumboldtii*.

Utricularia reniformis does not have negatively geotropic stolons to reach younger parts of the hosting bromeliad, in contrast to the case with *U. lumboldtii* (Studnicka, 2003). As a result, the stolons of *U. reniformis* occur within the basal senescent leaf sheaths of *Vriesea* only, where there is still plenty of water and planktonic lifeforms. The stolons also spread out of the bromeliad, growing independently thereafter in the moist humus. Once independent of its nascent bromeliad, the mature bladderwort can probably not invade a new bromeliad. The very tall flowering shoots of *Utricularia reniformis* apparently function to allow seeds to fall into new bromeliad urns and to germinate in the water standing therein.

The native ranges of the two types of *U. reniformis* discussed in this paper are not well documented. *Utricularia reniformis* 'Big Sister' occurs in Serra dos Órgãos, but also in Caminho do Mar near Sao Paulo (Lamb, 1992), and in so called campos rupestres, 1800 m, at Caraca, Minas Gerais State (Rivadavia, 1993). Information about the native range of *Utricularia reniformis* 'Enfant Terrible' is even more obscure. Based on the production of its epiphytic traps, I infer that the plant occurs in places with rather instable water conditions. Ule (1898) discussed a small variety of *Utricularia reniformis* (with a nomen nudum "*U. reniformis* var. *kromeri*") that was found growing in epiphytic bromeliads such as *Nidularium carolinae*, *Quesnelia lateralis*, a species of *Aechmea*, and *Vriesea hydrophora*, etc., in the Atlantic rain forest in Alto da Serra (max. alt. 1000 m) near Rio de Janeiro. These epiphytes are small, and their central water tanks may dry out periodically. This variety of *Utricularia reniformis* has not been relocated—is it identical with *Utricularia reniformis* 'Enfant Terrible'?

Conclusions

Two types of bladders (aquatic and epiphytic) were observed in *U. reniformis*. The aquatic bladders were regularly produced in *Utricularia reniformis* 'Big Sister', and only sporadically in *Utricularia reniformis* 'Enfant Terrible.' Epiphytic bladders were absent in *Utricularia reniformis* 'Big Sister,' but predominated in *Utricularia reniformis* 'Enfant Terrible.' The discrepancy of drawings from different authors (Luetzelburg, 1910; Taylor, 1989) was so explained.

The differences between the two cultivars of *Utricularia reniformis* are discussed in detail in Rice and Studnicka (2004), but to those observations (based upon leaf size and dimorphism) I have supplemented observations on the distribution of stomata. There are diacritical differences in the bladders of the two plants, expressed especially by the traps produced in soil.

The differences between the two cultivars are consistent and may ultimately support their classification as two species. More observations from their natural habitats are required, especially with respect to niche separation of the plants.

Utricularia reniformis 'Big Sister' was frequently observed in the field growing in leaf axils of a lithophytic bromeliad *Vriesea atra* at Pedra do Sino (Serra dos Órgãos). The symbiotic life strategy of this bladderwort—starting its life as a floating seedling in the central urn of the bromeliad—is very similar to *U. nelumbifolia* (cf. Goebel, 1893; Merl 1915, 1925; Studnicka, 2003). However, since *U. reniformis* does not produce an organ (such as an aerial shoot) to reach

the central urn of the bromeliad, with time it is relegated to the outer leaf axils of the bromeliad rosette. Ultimately, the plant spreads into wet humus and grows independent from the *Vriesea atra*.

Acknowledgements: I would like to thank Mrs. Olga Camisao from the Botanic Gardens of Rio de Janeiro for help to reach the mentioned location Pedra do Sino, and Mr. Jaroslav Smahel for his assistance in the rather difficult research realized there. Barry Rice was instrumental in writing this manuscript from my notes.

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NEW CULTIVARS

Keywords: cultivar: *Drosera spatulata* 'Ruby Slippers', *Utricularia reniformis* 'Big Sister', *Utricularia reniformis* 'Enfant Terrible'.

Drosera spatulata 'Ruby Slippers'

Submitted: 18 March 2003

In December of 2000 I sowed and germinated some seed originally obtained earlier from the Australian Carnivorous Plant Society seed bank. It was labeled as *Drosera spatulata* purported to have been collected from Kowloon Peak, Hong Kong. As the plants matured, I noticed that the plants took on a dark red pigmentation and have maintained that hue ever since (see Front Cover)

The entire leaf petiole and blade exhibit dark maroon to burgundy coloration when grown in strong light, though they can exhibit more green if grown in a reduced light environment. Mature plants reach 2.5 cm in diameter when grown under strong light, but may be somewhat larger if grown in lower light levels. The underside of the leaves are covered with long (3-4 mm) white hairs, parallel to the petiole, and which are visible on the newly forming leaves before they unfurl, and on the underside of fully formed leaves. The leaves are wedge shaped, having a very short petiole in proportion to the leaf blade, very reminiscent of *Drosera brevifolia*, though the leaf lamina are slightly wider, the plants are overall slightly larger, and more robust in appearance.

I grow many different clones of *Drosera spatulata*, all under fluorescent lights in the same conditions, but specimens of *Drosera* 'Ruby Slippers' are by far the most intensely red plants. The color of *Drosera spatulata* from Fraser Island, Queensland, Australia is similar, but those plants are somewhat larger.

Drosera 'Ruby Slippers' may be propagated by seed or vegetative means, but no matter how propagated the progeny must exhibit the dark red color and the form of the standard when grown under conditions of strong light.

They are tender perennials, persisting throughout the year. Mine have been growing continuously since germinating in December of 2000.

—WILLIAM JOSEPH CLEMENS • 13090 W. Camino de Conejo • Tucson, Arizona 85743-8872 • USA

Utricularia reniformis 'Big Sister'

Submitted: 15 March 2003

Some of the most spectacular *Utricularia* species are classified in the section *Iperua*. These plants include leafy leviathans such as *U. nelumbifolia*—with huge peltate leaves up to 10 cm in diameter on 45 cm long stalks—and floral goliaths such as *U. humboldtii* with flowers up to 10 cm across! *Utricularia reniformis* lives up to the high standards set by its brethren plants. Its reniform leaves are up to 14 cm in diameter, and crown petioles up to 65 cm tall (see Taylor, 1989, The Genus *Utricularia*—a Taxonomic Monograph, Her Majesty's Stationery Office, London)! Its flowers are large and ornate, with blue, yellow, violet, and purple elements.

There are two types of *Utricularia reniformis* in cultivation. Popular with horticulturists, these two plants are clearly in need of cultivar designation; we seek to correct this deficit.

The primary distinction between the two cultivars of *Utricularia reniformis* is size. At maturity, *Utricularia reniformis* 'Big Sister' consistently produces large leaves i.e. at least 8 cm in diameter (see Back Cover). One of us (MS) has even observed a greenhouse specimen with

leaves 22.2 cm in diameter, on a petiole 46 cm tall! Mature *Utricularia reniformis* 'Big Sister' specimens do not produce abundant small leaves (in contrast with *Utricularia reniformis* 'Enfant Terrible', described below). A second feature distinguishing the two cultivars is the incision into the leaf where the petiole attaches to the leaf blade. In *Utricularia* 'Big Sister', this cut is narrow (i.e. acute). See, for examples, the leaf lamina outlines in Taylor (1989), Figure 131 (figure elements 2,3,4). Floral characters are not considered important in distinguishing these two cultivars.

Of the two *Utricularia reniformis* cultivars, *Utricularia reniformis* 'Big Sister' seems to be slightly more challenging to grow well. The giant leaves are not developed to perfection if the conditions are inadequate. This plant may perhaps be treated best as an epiphyte, and should be grown in a comparatively light, airy mix. Humidity should be high.

Certainly *Utricularia reniformis* 'Big Sister' can be propagated easily by vegetative means, but plants produced by cross pollinating separate clones would be considered *Utricularia reniformis* 'Big Sister' as long as they produced the large leaves characteristic of the cultivar. *Utricularia* seedlings resulting from self-pollinations are sometimes nonvigorous, so we recommend the progeny of self pollinations (or even cross pollinations of plants that may be of closely related lineages) should be carefully evaluated for horticultural value. It is not known if the various clones of *Utricularia reniformis* 'Big Sister' in cultivation are genetically identical.

Additional aspects of this cultivar are discussed in the article on page 47.

—Barry Rice • P.O. Box 72741 • Davis, California • USA • barry@sarracenia.com

—Miloslav Studnicka • Botanic Gardens Liberec • Purkynova 1 • 460 01 Liberec • Czech Republic

Utricularia reniformis 'Enfant Terrible'

Submitted: 15 March 2003

Utricularia reniformis 'Enfant Terrible' is the smaller form of this species in cultivation. Its leaves never exceed approximately 4 cm in size, on petioles approximately 12 cm tall (see Figure 1). An interesting feature of this cultivar is the production of a carpet of minute ground-leaves under the large aerial-leaves. The diameters of these leaves range from as small as only a few mm to as large as a few cm (see Figure 2). Depending upon the cultivation conditions, *Utricularia reniformis* 'Enfant Terrible' may only have large aerial-leaves, minute ground-leaves, or both. In a relatively dry California greenhouse, one of us (BR) has observed this plant to grow only aerial leaves during the cool, amenable winter, and ground-leaves during the hotter, fierce summer.

Another feature distinguishing *Utricularia reniformis* 'Enfant Terrible' from *Utricularia reniformis* 'Big Sister' is in the nature of the leaf incision, where the petiole attaches to the leaf blade. In *Utricularia reniformis* 'Enfant Terrible', the incision is typically obtuse (instead of acute, as in *Utricularia reniformis* 'Big Sister'). For examples, refer to the leaf lamina drawings in Taylor (1989), in particular Figure 131 (figure elements 5,6,7).

Utricularia reniformis 'Enfant Terrible' is often confused with *Utricularia nephrophylla*, which has 0.1-1 cm leaf blades. While the ground-leaves of *Utricularia reniformis* 'Enfant Terrible' can mimic the appearance of *Utricularia nephrophylla*, the larger aerial leaves of *Utricularia reniformis* 'Enfant Terrible' are diagnostic. The flowers of these two species are also quite different.

Horticulturists who possess *Utricularia reniformis* 'Enfant Terrible' are sometimes frustrated by this plant when, despite heroic cultivation measures, it does not produce gigantic leaves. This is not *Utricularia reniformis* 'Big Sister'! On the other hand, *Utricularia reniformis* 'Enfant Terrible' survives easily in conditions where *Utricularia reniformis* 'Big Sister' might wither and perish.

Utricularia reniformis 'Enfant Terrible' is grown easily in a variety of mixes, but prefers a relatively light soil. It can be propagated vegetatively very easily. Plants propagated by sexual

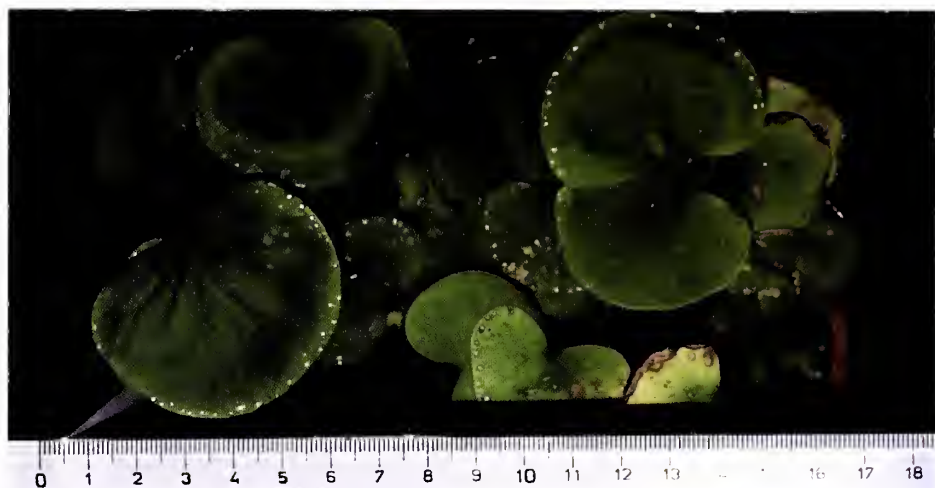


Figure 1: Large aerial leaf blades of *Utricularia reniformis* Enfant Terrible , grown at the Botanic Gardens Liberec. Photograph by Miloslav Studnicka.

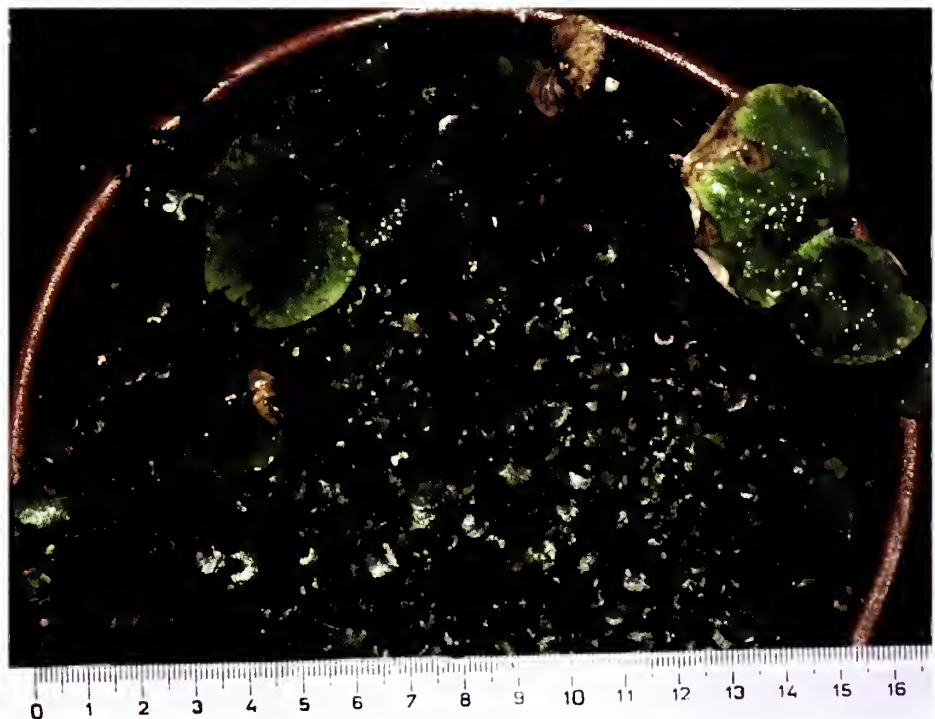


Figure 2: Minuscule ground-leaves of *Utricularia reniformis* Enfant Terrible , as they are seen below the aerial leaves. Photograph by Miloslav Studnicka.

means should be appraised carefully regarding vigor. If they produce small aerial-leaves and the minute ground-leaves, they would be considered specimens of *Utricularia reniformis* 'Enfant Terrible'.

Additional aspects of this cultivar are discussed in the article on page 47.

—Barry Rice • P.O. Box 72741 • Davis, California • USA • barry@sarracenia.com

—Miloslav Studnicka • Botanic Gardens Liberec • Purkynova 1 • 460 01 Liberec • Czech Republic

BOARD MEMBER ELECTIONS

The end of this year will mark the end of terms of office for three ICPS board members: Cindy Slezak (Vice President), John Brittnacher (Secretary), and Jan Schlauer (representing our editorial board). These three officers oversaw the ICPS during its major restructuring in which it gained 501(c)3 nonprofit status, became able to process VISA payments, completely restructured our seed bank, and adopted an electronic editorial process to simplify and speed the publication to our journal, Carnivorous Plant Newsletter. The other board members, as well as all the additional volunteers responsible for operating the ICPS, extend their thanks to these officers for the work they have done during their terms of office.

All three anticipate running for another term, but hard working members of the ICPS are encouraged to run for a board position. Please send a 250 word election statement to Barry Rice (contact information is on the inside cover of Carnivorous Plant Newsletter). Your election statements must be received by 1 August, 2004. In your statement, you may wish to note your experience, why you want to run for office, and what you wish to accomplish. Your statements will be printed in the September issue.

The ICPS is a growing, active organization. In order to participate as a board member, email access is essential. Furthermore, board members are expected to work hard! So while we welcome and encourage your interest as a board member, remember that it is more than a vanity post!

LOOKING BACK: CPN 25 YEARS AGO

Don Schnell noted that the great Yellow River site in Florida, famous for its pitcher plants, had an ominous For Sale sign: "Perhaps one of our Florida subscribers would like to check into this for us and let us know about acreage involved, exact portions of the location involved, cost, etc. There was no sign on the west side of the road, this being the side with the large open, disturbed wet area supporting tremendous growth of *Sarracenia rubra* and its hybrids with *S. leucophylla*."

In 2001 Bob Hanrahan took me (Barry Rice) back to the site, and we found that it had been completely destroyed. I managed to find one small plant each of *Drosera intermedia* and *Drosera capillaris*. The rest was gone.

In the News and Views section, page 37, John Watkins noted that he was interested in starting a carnivorous plant society in Great Britain. Was he successful? Ask any of the now 500 members of The Carnivorous Plant Society, or visit their great web site (<http://www.thecarnivorousplantsociety.org>) to find out for yourself!

ASPECTS OF ECOLOGY OF *DROSERA ROTUNDIFOLIA* L. AT THE WHITE SEA COAST

P.A. VOLKOVA • 119526, Prospect Vernadskogo St. • 95-3-123 • Moscow • Russia •
avolkov@orc.ru

Keywords: Ecology: *Drosera rotundifolia*, Russia.

Introduction

Carnivorous plants found in oligotrophic habitats capture animals to obtain nitrogen and other mineral substances (Brewer, 1998; Chandler & Anderson, 1976a; Krafft & Handel, 1991; Masing, 1959; Redbo-Torstensson, 1994). The contents of different mineral substances in the soil can significantly influence the characteristics of plants (Chandler & Anderson, 1976a; De Ridder & Dhondt, 1992; Redbo-Torstensson, 1994). Various authors have established the abundance of carnivorous plants in the moist habitats (Kats, 1941; Dixon & Pate, 1978; Aldenius *et al.*, 1983; Brewer, 1998).

The positive connection between the number of caught animals, the size of the plant, and the possibility of its flowering was shown for *Drosera* species by Kraft & Handel (1991) and Redbo-Torstensson (1994). Many authors have reported on the dependence of the possibility of flowering, the intensity of vegetative growth, and the success of insect-catching on the environmental factors (Dixon & Pate, 1978; De Ridder & Dhondt, 1992; Redbo-Torstensson, 1994). This is contrary to Brewer's (1998) opinion.

Many publications about *Drosera* species are connected with the study of the influence of insect-eating on *Drosera rotundifolia* morphology (Krafft & Handel, 1991; Balandin & Balandina, 1993; Redbo-Torstensson, 1994), and also with the physiological and biochemical aspects of the carnivory for *Drosera* species in the laboratory (Kellermann & Raumer, 1878; Darwin, 1875; Busgen, 1883; Poretskij, 1914; Chandler & Anderson, 1976a; Chandler & Anderson, 1976b; Pate & Dixon, 1978; Dixon *et al.*, 1980; Thum, 1986). A discussion on some broader aspects of *D. rotundifolia* ecology is also found in Thum (1986).

However, the experiments in the laboratory described in the majority of cited papers, do not take into account many factors (for example wind, strong rains and overheating) that have an essential influence on the vital functions of carnivorous plants (Chandler, Anderson, 1976a; Hanslin and Karlsson, 1996).

This field-based research project investigates the ecology of *Drosera rotundifolia*, with an emphasis on studying the influence of the environment on the plant's morphophysiological characteristics.

Materials and methods

In July-August of both 2000 and 2001 the flora of fifty-one islands of the Keretskiy archipelago and Keey bay (the White Sea) was investigated during Moscow South-West High School expeditions. *Drosera rotundifolia* was found at 31.4% of the investigated islands. This implies that *D. rotundifolia* is a species typical for the study area, but its distribution is probably limited by various environmental factors.

The investigation of the morphophysiological characteristics of *D. rotundifolia* at the various ecotopes was carried out at the northern part of the Karelian coast of the White Sea during July 23-August 11, 2001 (Figure 1). These 22 sites were laid in random manner on the populations of *D. rotundifolia*. Seven of these spots were situated on the islands in Keey bay and in the Keretskiy archipelago, and the others were situated at the continental lakeside. The surface area of all the areas were 0.04 m², except for one which was 0.02 m², and another which was 0.01

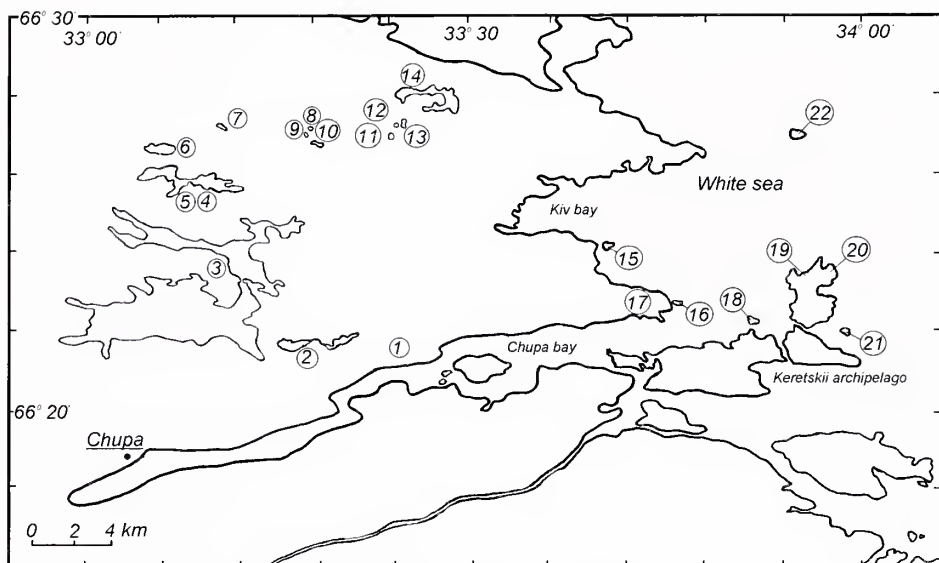


Figure 1: The region where *D. rotundifolia* was investigated. The study spots are indicated with numbers.

m². There were 222 *D. rotundifolia* plants in the sample area. During the investigation we also recorded all discovered plant species including mosses. Lichens were also recorded.

For each *D. rotundifolia* plant in our sample, we measured the leaf blade diameter of the largest leaf, the length of its petiole, the diameter of the leaf rosette, and (if present) the length of the flower stalk (see Figure 2). We also recorded the number of captured prey (see Figure 3), and the number of developing, active, and dead leaves for each plant.

We calculated the fractions of plants with caught animals, and the fractions of plants with developing leaves in the total number of *D. rotundifolia* plants on each site. We also estimated the capturing surface S of *D. rotundifolia* as $S = \pi d^2 N / 4$, where d is the diameter of the largest leaf blade, and N is the number of active leaves per plant (see Figure 4). (The largest leaf blade diam-

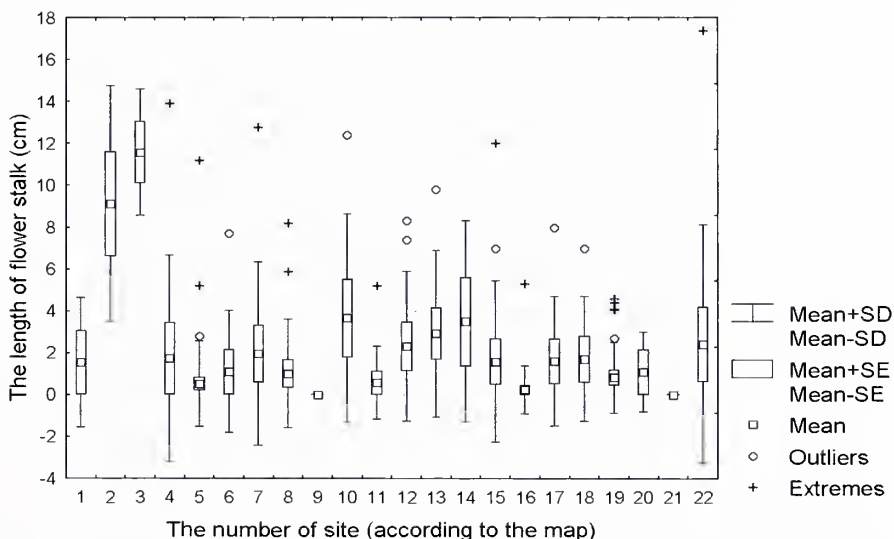


Figure 2: The length of flower stalk (with flowers) of *D. rotundifolia* plants for each of the investigated sites.

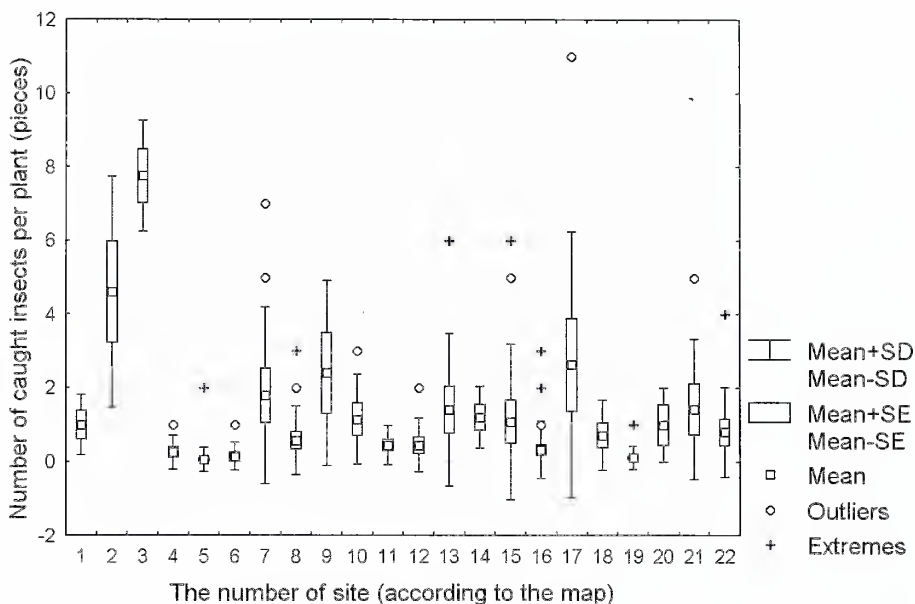


Figure 3: The number of caught animals per *D. rotundifolia* plant for each of the investigated sites.

eter was used to estimate the size each leaf would become at its point of maximum development.) Indicator-species plants observed at each site were used to estimate the site's environmental factors.

It is well known that a *D. rotundifolia* seedling can reach its full size within one vegetative season (Thum, 1986; Kraft & Handel, 1991). As such, we can use the size of the vegetative parts of each plant as a characteristic of the intensity of its vegetative growth, and the length of flowering stalk as a characteristic of the plant's reproductive intensity. The number of animals caught by each plant can be used as the characteristic of the success of insect catching by the plant.

A factorial analysis of the site-averaged values of *D. rotundifolia* morphophysiological characteristics was carried out (see Figure 5). Cluster and discriminate analyses of morphophysiological characteristics for each of observed *D. rotundifolia* plants were made. We also used the t-test for independent samples to compare average leaf length and average catching surface under different environmental conditions. The distribution of the plants into clusters was tested by performing a χ^2 goodness of fit test to the Poisson distribution. The parametric correlation analysis of our data was carried out. The statistical data processing was performed using the STATISTICA program package (StatSoft, Inc.).

Results and analysis

A factorial analysis of the spot-averaged values of *D. rotundifolia* morphophysiological characteristics was carried out (Figure 2). Two factors completely describing the plant development were found. Factor #1 describes the intensity of reproduction and vegetative growth of *D. rotundifolia* and the success of its insect catching. Factor #2 describes the spot-averaged quantity of developing leaves (which are not unfolded and so can not catch prey) and the percentage of plants with such type of leaves located on this spot.

The correlation analysis of the obtained data shows that the success of insect catching by *D. rotundifolia*, intensity of its reproduction, and vegetative growth are related to each other ($N=222$, $r=0.48-0.61$, $p<0.05$). This conclusion confirms the data obtained by Kraft & Handel (1991) and Redbo-Torstensson (1994).

The increase in a density of *D. rotundifolia* on any spot leads to the decrease of the num-

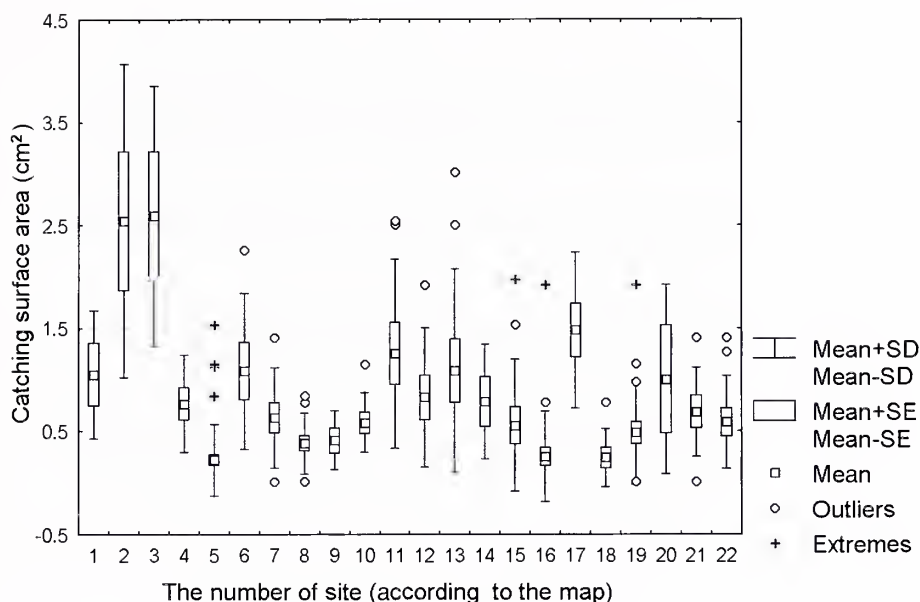


Figure 4: The capturing surface of *D. rotundifolia* plants for each of the investigated sites.

ber of plants with captured prey at the spot ($N=22$, $r=-0.50$, $p<0.05$). This suggests intrapopulation competition for prey. As the density of plants on a spot increases, the length of their active leaves (i.e. that are capable of capturing animals) decreases ($N=22$, $r=-0.50$, $p<0.05$). Thus the overlapping of active leaves is prevented, allowing for decreased competition for prey within a population.

Most of the *D. rotundifolia* grew on sphagnum spots (36.4% of the 22 investigated populations) or on bogs situated on the heights formed by rocky outcrops (27.3% of the 22 investigated populations). Populations were also found on typical raised bogs (13.6%); in sparse waterlogged stands of conifers with *Betula nana* (9.1%); on a stony ground (9.1%); and once on a moist track (4.5%). All these ecotopes can be characterized by treeless or sparse pine woods, and little or no slope. In such exposed environments, plants have little wind protection or shading. The exposure to the wind may increase the probability of catching flying animals, while the high light levels promote active leaf formation (Masing, 1959; Chandler & Anderson, 1976a; Redbo-Torstensson, 1994; Brewer, 1998).

Drosera rotundifolia usually grows in association with *Vaccinium oxycoccus*, *Rubus chamaemorus*, *Empetrum hermaphroditum* and *Sphagnum fuscum* (Various species of *Sphagnum* occur at 90.9% of the sites).

In the cluster analysis of morphophysiological characteristics, all the investigated plants were divided into seven clusters, one of which included about one third of the total plants. For ten of the investigation spots, more than 50% of the plants were included in this large cluster. In most cases, plants from the a single spot distribute themselves more or less uniformly into 2-4 various clusters. ($\chi^2=242.3$, 11 degrees of freedom, $P=0.0$). According to results of discriminant analysis only 39.6% of the total number of the investigated instances of *D. rotundifolia* are grouped by morphophysiological characteristics according to their location. This confirms there is no significant influence of the environment on the morphophysiological characteristics of *D. rotundifolia* in our study area.

The largest active *D. rotundifolia* leaf had a greater diameter if *Andromeda polifolia* is present, than if *A. polifolia* is absent (0.4 ± 0.03 cm and 0.3 ± 0.01 cm, respectively). Redbo-Torstensson (1994) noted the increase of the *A. polifolia* density after the addition of nitrogen in the soil, the occurrence of *A. polifolia* probably indicates increased soil nitrogen levels. As such,

it is likely that the size of *D. rotundifolia* depends positively on the nitrogen content in the soil.

The leaf-trapping surface area of *D. rotundifolia* is greater in the presence of *Carex pauciflora* than when *C. pauciflora* is absent (1.14 ± 0.16 and 0.62 ± 0.05 respectively). *Carex pauciflora* is considered to be a plant typical of damp ecotopes (Katz, 1941), so it follows that the total leaf trapping area of *D. rotundifolia* depends positively on a moistness of its ecotope. Such dependence can be hypothesized as being due to the increased water demand of a larger, transpiring leaf surface that is covered by secretory glands. This hypothesis explains the observations of many authors (e.g. Katz, 1941; Dixon & Pate, 1978; Aldenius *et al.*, 1983; de Ridder & Dhondt, 1992; Brewer, 1998; and others) about the confinement of carnivore plants to damp ecotopes.

The number density of the plants in the investigated spots varied from 75 m^{-2} up to 925 m^{-2} , and the average value was $256 \pm 43.8 \text{ m}^{-2}$. Redbo-Torstensson (1994) reports densities of $380\text{--}520 \text{ m}^{-2}$. The disparity in number densities can probably be explained by the fewer types of ecotypes Redbo-Torstensson investigated. Thum (1986) recorded $405 \text{ plants m}^{-2}$ at a small silted bog in Germany—this suggests that the density of *D. rotundifolia* varies considerably according to its environment. This fact suggests that the density of *D. rotundifolia* varies considerably according to its environment.

In summary, we conclude:

1. The success of insect catching, intensity of reproduction and vegetative growth of *D. rotundi-*

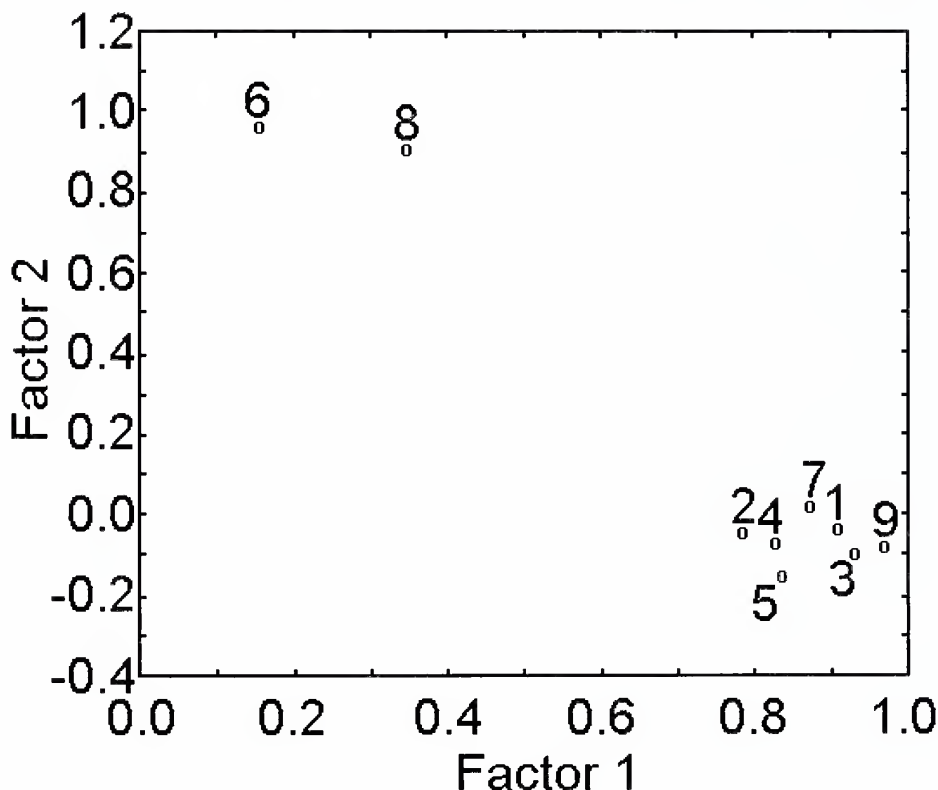


Figure 5: The results of factorial analysis of the spot-averaged values of *D. rotundifolia* morphophysiological characteristics. 1- the diameter of the blade of the greatest active leaf; 2- the petiole length of the greatest active leaf; 3- the diameter of the leaf rosette; 4- the number of prey per plant; 5- the number of active leaves per plant; 6- the number of developing leaves per plant; 7- the length of the flower stalk; 8- the percentage of plants with developing leaves; 9- the whole catching surface of the plant.

folia, and the quantity of its developing leaves completely characterize the development of this species.

2. There is an intrapopulation prey competition within populations of *D. rotundifolia*.

3. Usually *D. rotundifolia* grows in raised bogs and waterlogged ecotopes.

4. The size of *D. rotundifolia* depends positively on the nitrogen content in the soil.

5. The total prey-trapping leaf surface area of *D. rotundifolia* depends positively on the moisture level of its environment.

6. The number density of *D. rotundifolia* varies considerably, depending on its environment.

Acknowledgements.

The investigations were carried out in the framework of Moscow South-West High School. I am indebted to my supervisor Dr. Biol Sc. Shupunov A. B. and all teachers and pupils who helped me in field work.

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LITERATURE REVIEWS

Casper, S.J. & Urquiola Cruz, A.J. 2003, *Pinguicula cubensis* (Lentibulariaceae)—a New Insectivorous Species from Western Cuba (Cuba occidental). Willdenowia 33: 167-172.

The new species is closely related to *P. albida* that grows in the immediate neighbourhood. It differs by its strongly involute leaf margins, suberect juvenile leaves, and a bilabiate corolla. With two other recent discoveries (cf. CPN 32:122, 2003), Cuba is now known to host at least eight indigenous *Pinguicula* species. (JS)

Harley, R.M., Giulietti, A.M. & Dos Santos, F.A.R. 2003, *Holoregnia* Nees, a Recently Rediscovered Genus of Martyniaceae from Bahia, Brazil. Kew Bull. 58: 205-212.

The paper re-establishes the genus *Holoregnia* that had been united with *Craniolaria* in the past. A few observations are communicated on the phenology of the single species *H. viscida* that is endemic to the caatinga region of NE Brazil. Carnivory is not discussed (NB: Martyniaceae is a family that contains several sub-carnivorous genera like e.g. *Ibicella* but no endogenous digestive properties have been detected so far). (JS)

Lee, C.C. 2002, *Nepenthes platychlila* (Nepenthaceae), a New Species of Pitcher Plant from Sarawak, Borneo. Gard. Bull. Singapore 54: 257-261.

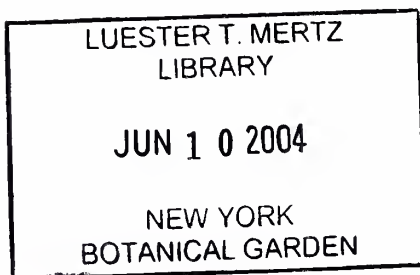
Nepenthes platychlila differs by a very expanded and flat peristome from all other Bornean species (only *N. jacquelineae* from Sumatra is somewhat similar but not considered closely related). The author compares it to *N. fusca*. (JS)

Maldonado San Martin, A.P., Adamec, L., Suda, J., Mes, T.H.M. & Storchova, H. 2003, Genetic Variation within the Endangered Species *Aldrovanda vesiculosa* (Droseraceae) as Revealed by RAPD Analysis. Aquatic Bot. 75: 159-172.

A low genetic diversity was found among twelve accessions (from Europe, Japan, and Australia) of *A. vesiculosa*: 151 primers were required to find 21 primers with 79 polymorphic markers. Several reasons may account for this situation, which is also found in a number of other aquatic plants. The authors consider uniform nature of the habitat, high frequency of asexual reproduction, and long-distance dispersal. Unfortunately, no outgroup comparison was made (e.g. with the terrestrial, not widespread *Dionaea*), so the overall significance of these findings cannot be verified. (JS)

Seno, J. 2003, A New Natural Hybrid of *Drosera* (Droseraceae) from Miyazaki Prefecture, Southwestern Japan. J.Japanese Bot. 78: 170-174.

Within the hybridogenic *D. tokaiensis* (= *D. rotundifolia* × *D. spatulata*), sterile plants with a chromosome count of $2n = 30$ are distinguished as a new subspecies, *D. tokaiensis* subsp. *hyugaensis*. (JS)



INSTRUCTIONS TO AUTHORS

Carnivorous Plant Newsletter is the official journal of The International Carnivorous Plant Society. It is dedicated to the distribution of knowledge about carnivorous plants, including information on cultivation, conservation, and related fields of botany. Carnivorous Plant Newsletter thrives only because of a steady stream of material from its readership; members of the Society are encouraged to submit articles.

It may take up to a year or more for a contribution to be published, and any manuscript may be edited to some degree prior to publication. Concise and clear writing will result in the minimum number of editorial changes. Authors will be contacted only if the editorial modifications are significant. If your manuscript is a scientific work, the editors may request external peer reviews. If certain external peers should be excluded from the reviewing process, this must be stated in a cover letter.

All contributions except News & Views pieces must have a title. Include a list of the names and addresses of all the authors. Indicate which author should be contacted if we require more information. If possible, include an e-mail address for this author. This information will be published unless you request otherwise.

Full citation of all references quoted in the text must be provided in a section following the text of the manuscript. All illustrations, diagrams, and tables must include descriptive captions. Include these captions at the end of your manuscript. For format style, follow the examples of recent articles in the Newsletter.

Contributions shorter than 250 words can be submitted on paper, but it must be typed or computer-printed. Longer documents must be submitted on a CD or 3.5 inch computer disk (PC format) or by e-mail (either in the body of your e-mail or as an attachment). Electronic documents should be in Microsoft Word (.doc), rich text format (.rtf), or ascii text (.txt). You should also send a hardcopy of your documents to Barry Rice (address below) to ensure your tables or special character accents are reproduced correctly.

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Barry A. Rice
P.O. Box 72741
Davis, CA 95617 USA
E-mail: barry@carnivorousplants.org

Jan Schlauer
Zwischenstr. 11
D-60594 Frankfurt, Germany
E-mail: jan@carnivorousplants.org

